Original Article

Outcome of thulium laser enucleation of prostate surgery in high-risk patients with benign prostatic hyperplasia

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Abstract

Background: Benign prostatic hyperplasia (BPH) is one of the most common diseases in aging men and a significant cause of burden worldwide. Here, we report our experience of Thulium LASER enucleation of the prostate (ThuLEP) in high-risk patients with BPH.

Methods: This was a prospective study conducted between July 2011 and June 2016. The study participants were patients with a confirmed diagnosis of BPH, who required surgery, and were clinically eligible for ThuLEP.

Results: A total of 109 patients were included in the study. Of the total 109 patients, 82 patients had American Society of Anesthesiologists (ASA) Grade 3 and 27 had ASA Grade 4. The most common comorbidity was ischemic heart diseases (72.5%), followed by hypertension (57.8%) and diabetes mellitus (48.6%). During the procedure, a total of 11 (10.1%) patients had a fall in blood pressure requiring noradrenaline or mephentine and seven (6.4%) patients had early left ventricular failure. Sixteen (14.8%) patients had arrhythmias (benign) and seven (6.4%) patients with arrhythmias required antiarrhythmic drugs. The overall duration of surgery ranged from 55 to 70 min, laser time ranged from 25 to 35 min, hospital stay ranged from 30 to 36 h, and the mean catheter time was around 24 h. Overall, the change in hemoglobin ranged from 0.5 to 0.8 g/dL.

Conclusion: Results show that ThuLEP could be a better option in high-risk patients with BPH.

Keywords: Benign prostatic hyperplasia, enucleation, mortality, thulium laser

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INTRODUCTION

Benign prostatic hyperplasia (BPH) is one of the most common diseases in aging men and a significant cause of burden worldwide. Patients with BPH are generally associated with lower urinary tract symptoms which have a significant impact on the quality of life (QoL) and sleep patterns affecting daily life. The prevalence of BPH increases with age and has been reported from 25% in 40–49 years of age to 80% in 70–79 years of age.[1]

There is a continuous evolution in making a safe and effective tool to treat BPH, especially in high-risk individuals, where a significant morbidity and mortality is involved in established procedures such as transurethral resection of prostate (TURP). Thulium LASER has all the ingredients to make it a perfect tool to treat BPH in these high-risk patients.[2] TURP was the gold standard until the last few decades, but, currently, the most commonly used techniques are contact laser for photoselective vaporization of the prostate (PVP) or

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laser-induced enucleation of obstructive prostate tissue. Several laser vaporization devices are used including thulium LASER.[2]

Several studies, systematic reviews, and meta-analysis have demonstrated the usefulness of ThuLEP in patients with BPH.[3-8] There are continuous efforts in making a safe and effective tool for the management of BPH, especially in high-risk individuals, where a significant morbidity and mortality is involved in established procedures such as TURP. To the best of our knowledge, there is no literature available on the use of ThuLEP for high-risk patients. In this article, we report our experience of ThuLEP in high-risk patients (patients with American Society of Anesthesiologists [ASA] Grade 3 or 4 based on the ASA' classification of physical health).[9]

METHODS

Patients and study design

This was a prospective study conducted between July 2011 and June 2016 at two study centers. The study participants were patients with a confirmed diagnosis of BPH with significant bladder outlet obstruction and were clinically eligible for thulium LASER enucleation of the prostate (ThuLEP) at the discretion of the treating surgeon. The key inclusion criteria were patients of BPH with medical comorbidities of ASA Grade 3 or 4 (high risk), maximum urinary flow rate (Q_{max}) <15 ml/s and International Prostate Symptom Score (IPSS) >15, or acute retention of urine with the failure of catheter trial, or with a prior history of severe bladder outlet obstruction. Patients with neurogenic bladder, associated strictures or bladder stones, patients operated by other urologists, and patients converted to TURP due to laser malfunction or malfunction of morcellator that led to the removal of chips by TURP were excluded from the study. Patients with ASA Grades 1, 2, and 5 were also excluded from the study.

The study protocol was reviewed and approved by the institutional review board. The study was conducted in accordance with the approved International Conference on Harmonization Good Clinical Practice guidelines and the ethical principles that have their origin in the Declaration of Helsinki. Each study participant provided written informed consent before participation in the study.

Presurgical assessment included IPSS, digital rectal examination, uroflowmetry, prostate-specific antigen (PSA), and routine pathological evaluation. Abdominal ultrasonography, transrectal ultrasonography (TRUS), and, if indicated, TRUS-guided biopsies were done.

Other investigations, as appropriate, were hemogram, serum creatinine, blood sugar, HIV, HBsAg, prothrombin time, partial thromboplastin time, serum electrolytes, electrocardiogram, and two-dimensional echocardiography. Comorbidities were also noted. A multidisciplinary approach was employed as needed including, but not limited to, a chest physician for chronic obstructive pulmonary disease (COPD), a cardiologist for ischemic heart disease or arrhythmias, a vascular surgeon for deep vein thrombosis, and a psychiatrist for psychiatric illnesses. Whenever possible, antiplatelet agents were stopped 5 days prior to the surgery; nebulization was given to patients with COPD. To evaluate the physical status, the ASA physical status classification was used.[9]

Surgical procedure

All the procedures were performed by a single surgeon at two different institutes using 120-W Quanta (Italy) systems' Thulium LASER machine with 600-μ fiber, the standard resectoscope, and Kuntz working element (Richard–Wolf), along with Richard–Wolf Piranha morcellator, and morsoscope. If the median lobes were large, the three-lobar enucleation technique was used, and if the median lobe was not significant, two-lobar technique was used.

The incision was taken at 5 o'clock and 7 o'clock positions and deepened till the capsule, from the bladder neck till verumontanum, and then joining them together, delineating the capsule all along. The median lobe was disconnected and pushed into the bladder. The lateral lobes were dissected starting from 12 o'clock to 5 o'clock position, using laser energy, and from 12 o'clock to 7 o'clock position. The lobes were then morcellated. In patients with insignificant median lobes, an alternative incision (6 o'clock) was taken instead of 5 o'clock and 7 o'clock positions. The laser energy used ranged from 35 W to 80 W. Preoperative hemoglobin and hemoglobin after 24 h after surgery were compared to document the blood loss. Histopathology reporting was done in all patients. All the associated events in intraoperative, immediate postoperative, and till 6-week postoperative period were documented, such as duration of surgery, prostate size, and postoperative pain. Serum PSA and IPSS scores were compared preoperatively and 4–6 weeks postoperatively. All the records of intraoperative as well as postoperative vital statistics were maintained, such as pulse, blood pressure (BP), oxygen saturation, and blood sugar levels and were closely monitored for the period of admission.

Intraoperative and postoperative evaluations were studied till 36 h or (till the discharge), after 1 week and at 1 month.

All patients were followed up for a period of minimum 7 months.

RESULTS

A total of 831 patients underwent ThuLEP during the study period, of which 109 patients had ASA Grade 3 or 4. Table 1 shows the baseline demographics and clinical characteristics, and Table 2 shows comorbidities. The overall age of the patients ranged from 50 to 95 years. The majority of the patients were aged between 60 and 70 years. A total of 27 patients were aged between 80 and 90 years and six patients were aged more than 90 years. The baseline hemoglobin ranged from 10.0% to 13.5%, and the IPSS score ranged from 15 to 35. The baseline prostate volume ranged from 43 to 198 ml, and the PSA value ranged from 2 to 22 ng/ml. Of the total 109 patients, 82 patients had ASA status Grade 3 and 27 had ASA Grade 4.

The most common comorbidity was ischemic heart diseases (72.5%), followed by hypertension (57.8%) and diabetes mellitus (48.6%).

A total of 19 patients were on aspirin (acetylsalicylic acid) and three patients were on aspirin plus clopidogrel. A 20 Fr Foley's catheter was inserted postoperatively. Traction on Foley's catheter was not given in any patients except for two patients with significant hematuria in the immediate postoperative period. The catheter was removed within 24 h postoperatively in 105 (96.3%) patients and within 48 h in 4 (3.7%) patients. One patient had not cleared urine totally without irrigation fluids (hematuria not stopped totally). Hence, catheter removal was delayed until 48 h and for three patients on aspirin plus clopidogrel, it was done as a precautionary measure.

During the procedure, a total of 11 (10.1%) patients had a fall in BP requiring noradrenaline or mephentine, seven (6.4%) patients had early left ventricular failure (LVF) who were treated with diuretics, and two (1.8%) patients with LVF required bi-level positive airway pressure ventilation. Sixteen (14.8%) patients had arrhythmias (benign) and seven (6.4%) patients with arrhythmias required antiarrhythmic drugs. Two patients required psychiatric treatment and one patient had a transient ischemic attack. One patient died due to massive myocardial infarction after 36 h of the surgery while he was waiting for the discharge.

As a protocol, the patients who were hemodynamically stable and were ASA Grade 3 were treated in wards or rooms and those with ASA Grade 4 or those who were having hypotension, LVF, etc., were treated in the intensive care unit. During the postoperative period, a total of 18 patients were treated in the intensive care unit. Table 3 summarizes operative and perioperative outcomes. The overall duration of surgery ranged from 55 to 70 min, laser time ranged from 25 to 35 min, hospital stay ranged from 30 to 36 h (only four patients discharged after 48 h), and the mean catheter time was around 24 h. Overall, the change in hemoglobin ranged from 0.5 to 0.8 g/dL.

Table 1: Baseline demographics and clinical characteristics

Parameter	*n*=109
Age (years), *n* (%)	
50-60	6 (5.5)
60-70	41 (37.6)
70-80	29 (26.6)
80-90	27 (24.8)
>90	6 (5.5)
ASA grade, *n* (%)	
Grade 3	82 (75.23)
Grade 4	27 (24.77)
Hemoglobin, range	10.0-13.5
IPSS score, range	25-35
Prostate volume (ml), range	43-198
PSA (ng/ml), range	1.5-22

Data presented as mean (SD), unless otherwise specified. ASA: American Society of Anesthesiologists, IPSS: International Prostate Symptom Score, PSA: Prostate-specific antigen, SD: Standard deviation

Table 2: Summary of comorbidities

Parameter	*n*=109
Ischemic heart disease	79 (72.5)
Hypertension	63 (57.8)
Diabetes mellitus	53 (48.6)
COPD	24 (22.0)
LVEF (%)	
50-60	21 (19.3)
40-50	9 (8.3)
30-40	6 (5.5)
Arrhythmias on medical treatment	14 (12.8)
CKD (creatinine >1.8)	11 (10.1)
Psychiatric problems	8 (7.3)
On pacemakers	7 (6.4)
Obesity BMI >30	7 (6.4)
Peripheral vascular disease/atherosclerosis	4 (3.7)
Transient ischemic attack	3 (2.8)
CKD on hemodialysis	3 (2.8)
Blindness	3 (2.8)
Severe kyphoscoliosis	3 (2.8)

Data presented as *n* (%). BMI: Body mass index, COPD: Chronic obstructive pulmonary disease, CKD: Chronic kidney disease, LVEF: Left ventricular ejection fraction

Table 3: Summary of operative and perioperative outcomes

Outcomes	*n*=109
Duration of surgery (min)	55-70
Laser time (min)	25-35
Change in serum hemoglobin (g/dL)	0.5-0.8
Hospital stay (h)	36-48
Catheter time (h), mean	24

Data presented as range, unless otherwise specified

The most common adverse event was arrhythmias (benign) (n = 16, 14.6%), followed by fall in BP requiring noradrenaline or mephentine (n = 11, 10%) and early LVF treated with diuretics (n = 7, 6.4%) [Table 4]. A total of seven patients (6.4%) with arrhythmia required antiarrhythmic drugs. There was only one death in the study who died within 1 week of the procedure due to massive myocardial infarction.

DISCUSSION

Although BPH is not a life-threatening condition, it has a significant impact on the QoL of a patient. Hence, in severe condition, surgical intervention is necessary such as TURP and LASER enucleation or vaporization. Several novel lasers have been introduced in the last few decades for the treatment of BPH. In a recent network meta-analysis, different lasers used in the treatment of BPH were evaluated from 36 studies involving 3831 patients.[10] Different laser treatments included green light laser (vaporization), green light (vapo-enucleation), holmium laser (enucleation), holmium laser (resection), thulium LASER (vaporesection), Nd:YAG (vaporization), KTP/Nd:YAG (vaporization), and diode laser (vaporization). This network meta-analysis showed that TURP was the most common intervention implicated for comparison among laser techniques in these studies, and direct comparisons among laser techniques were very less. The authors concluded that holmium and thulium LASERs seem to be relatively better in surgical efficacy and safety, compared to other lasers.

This report summarizes our experience of ThuLEP in high-risk patients. In this study, a total of 109 patients with ASA Grade 3 or 4 were summarized. The majority of patients ranged between 60 and 70 years, and the most common comorbidities were ischemic heart diseases, hypertension, and diabetes mellitus. Even though there were a few episodes of medical emergencies during or in the immediate postoperative period such as drop in BP and arrhythmias, they could be managed easily and the patient outcome was safe. There was only one death after 36 h. Although there are several studies which evaluated the utilization of ThuLEP in patients with BPH, there is limited data available among high-risk patients and to our knowledge, there is no data on ThuLEP in high-risk patients.

Table 4: Summary of adverse events

Adverse events	n=109
Arrhythmias (benign)	16 (14.6)
Fall in BP requiring noradrenaline/mephentine	11 (10)
Early LVF treated with diuretics	7 (6.4)
Arrhythmias requiring antiarrhythmic drugs	7 (6.4)
LVF requiring BiPAP ventilation	2 (1.8)
Psychiatric treatment	2 (1.8)
Death within a week (massive myocardial infarct after 36 h)*	1 (0.9)

*There was only one death in the study. BP: Blood pressure, BiPAP: Bi-level positive airway pressure, LVF: Left ventricular failure

Zhu *et al.* compared the safety and efficacy of the thulium LASER vaporesection and transurethral electrovaporization of the prostate for the treatment of high-risk patients with BPH (ASA Classes II and III) and found that thulium LASER vaporesection of the prostate was slightly superior to transurethral electrovaporization of the prostate in catheterization time (2.1 ± 0.9 vs. 4.5 ± 1.3 days) and postoperative hospital stay (4.4 ± 1.8 vs. 6.6 ± 2.0 days), respectively; however, the postoperative change in hemoglobin was -3 and -10 g/L, respectively.[11] In the present study, catheterization time was 24 h and postoperative hospital stay was 36 h, which were comparatively better than those of the thulium LASER vaporesection and transurethral electrovaporization; however, the change in hemoglobin was between 0.5 and 0.8 g/dL, which was comparable.

Another Chinese study by Liu *et al.* compared the effects of green light photoselective vaporization prostatectomy (PVP) and ThuLEP vaporesection of the prostate (TmLRP) in 118 high-risk BPH patients aged 62–96 years.[12] Results showed that the mean operation time and postoperative bladder irrigation time were significantly less in the TmLRP than that in the PVP group; however, both TmLRP and PVP improved IPSS, QoL, PVR, and Q_{max} in high-risk patients.

In the present study, the duration of surgery ranged from 55 to 70 min and the laser time ranged from 25 to 35 min. However, in a previous report by Zhu *et al.*, the operative time of Thulium LASER vaporesection and transurethral electrovaporization was 66.8 and 61.8 min, respectively.[11] In another study, the mean operative time was found to be 56.91 min.[3] Overall, the duration of surgery in this study was comparable with that of the previous reports despite our patients were high-risk patients (ASA Grade 3 or 4).

The author acknowledges few limitations of this study. First, the study had no comparator group. Second, the long-term data were not available. Third, the sample size was comparatively low; hence, care must be taken when generalizing the results.

CONCLUSION

Overall, with the above limitations, results demonstrate that ThuLEP could be a better option in high-risk patients

with BPH. Further research could be needed to confirm these results.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Sarma AV, Wei JT. Clinical practice. Benign prostatic hyperplasia and lower urinary tract symptoms. N Engl J Med 2012;367:248-57.
2. Braeckman J, Denis L. Management of BPH then 2000 and now 2016 – From BPH to BPO. Asian J Urol 2017;4:138-47.
3. Ketan PV, Prashant HS. Thulium laser enucleation of the prostate is a safe and a highly effective modality for the treatment of benign prostatic hyperplasia – Our experience of 236 patients. Urol Ann 2016;8:76-80.
4. Zhang F, Shao Q, Herrmann TR, Tian Y, Zhang Y. Thulium laser versus holmium laser transurethral enucleation of the prostate: 18-month follow-up data of a single center. Urology 2012;79:869-74.
5. Bozzini G, Seveso M, Melegari S, de Francesco O, Buffi NM, Guazzoni G, *et al*. Thulium laser enucleation (ThuLEP) versus transurethral resection of the prostate in saline (TURis): A randomized prospective trial to compare intra and early postoperative outcomes. Actas Urol Esp 2017;41:309-15.
6. Iacono F, Prezioso D, Di Lauro G, Romeo G, Ruffo A, Illiano E, *et al*. Efficacy and safety profile of a novel technique, thuLEP (Thulium laser enucleation of the prostate) for the treatment of benign prostate hypertrophy. Our experience on 148 patients. BMC Surg 2012;12 Suppl 1:S21.
7. Jiang H, Zhou Y. Safety and efficacy of thulium laser prostatectomy versus transurethral resection of prostate for treatment of benign prostate hyperplasia: A meta-analysis. Low Urin Tract Symptoms 2016;8:165-70.
8. Zhu Y, Zhuo J, Xu D, Xia S, Herrmann TR. Thulium laser versus standard transurethral resection of the prostate for benign prostatic obstruction: A systematic review and meta-analysis. World J Urol 2015;33:509-15.
9. ASA Physical Status Classification System. Last Approved by the ASA House of Delegates; October 15, 2014. Available from: https://www.asahq.org/resources/clinical-information/asa-physical-status-classification-system. [Last accessed on 2018 May 12].
10. Zhang X, Shen P, He Q, Yin X, Chen Z, Gui H, *et al*. Different lasers in the treatment of benign prostatic hyperplasia: A network meta-analysis. Sci Rep 2016;6:23503.
11. Zhu Z, Shen Z, Tu F, Zhu Y, Sun F, Shao Y, *et al*. Thulium laser vaporesection versus transurethral electrovaporization of the prostate in high-risk patients with benign prostatic hyperplasia. Photomed Laser Surg 2012;30:714-8.
12. Liu CL, Xue DW, Liu YL, Wang P. Greenlight photoselective vaporization prostatectomy versus thulium laser vaporesection of the prostate for aged high-risk BPH patients with the prostate heavier than 80 g. Zhonghua Nan Ke Xue 2011;17:431-4.